Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

struggle for existence, and perhaps consider that the metamorphoses of the animal within the egg are due to a reflex action of the modes of life of the ancestors of the animal on the embryos of its descendants.

EXPLANATION OF PLATE 1.

Fig. 1. *Colpocephalum lari* Pack. 1*a*, antenna. The short line by the side gives the length of the insect.
Fig. 2. *Lipeurus corvi* Pack. 2*a*, antenna.
" 3. *Docophorus buteonis* Pack. 3*a*, antenna.
" 4. *Lipeurus elongatus* Pack. 4*a*, antenna.
" 5. *Nirmus thoracicus* Pack.
" 6. *Lipeurus gracilis* Pack.
" 7. *Docophorus hamatus* Pack.

NOTES ON FRESH-WATER FISHES OF NEW JERSEY.

BY CHARLES C. ABBOTT, M. D.

THE character of the Delaware River, in the vicinity of Trenton, New Jersey, the head of navigation, is quite varied; the bed is stony, with scattered large rocks above the rapids, and sandy, with some vegetation below the falls; the current is swift to the rapids, but less so, being tide water, below them; these conditions, with that of the varied character of the tributaries at and near Trenton, make it an excellent point at which to examine the ichthyology of this river basin. This has been done partly by those who have received collections therefrom; but there is nothing in the publications of their studies giving any knowledge of the habits of these fish, but simply the fact of their presence in these waters.

The ichthyic fauna is quite large, as some streams are cold and swift, that until lately harbored trout; and other streams, sluggish and thick, that are paradisiacal to the mudfish (*Melanura*), and the sucker (*Hylomyzon*).

In the present paper we propose not only to mention the results of the study of the habits of the species particularized, but to refer also to observations we have made, that apply to the fishes of these waters as a class, rather than to any single species. These observations we will give first, and then notice separately the more interesting species, in conclusion.

We would first call attention to *alterations in circumscribed faunæ.* These changes are what have occurred lately in the small brooks, either emptying into the river directly, or tributary to the two large creeks, the Assunpink, and Crosswicks. We give only such instances as have occurred under our own notice. In the month of June, 1867, we fished the entire length of a never failing spring-brook, remarkable always for the number of specimens, if not of species. The fauna consisted, as usual, of chubs (*Semotilus rhotheus* and *S. corporalis*) ; dace (*Argyreus atronasus*), and minnows (*Fundulus multifasciatus*). The abundance of these species was relatively as named. During the first week of July following, a heavy, sudden fall of rain caused a considerable rise in the brook, and the extra bulk of water rushing over the narrow bed, altered the character of the brook so slightly, that it attracted no notice from those accustomed to seeing it daily. On the subsidence of the water, no cyprinoids, or in fact other fish, could be found, although we left hundreds in the stream. A week later we found a few roach (*Stilbe Americana*) ; they were never seen by us previously, in this stream, and still later, young mullet (*Moxostoma oblongum*). No chub have since been seen in this brook, which during the summer past (1869), was well tenanted with the species substituted in 1867, for them. During the last summer a few red-fins (*Hypsilepis cornutus*), and shiner (*Hypsilepis Kentuckiensis*), made their appearance. In a similar instance, happening in 1868, a familiar creek, teeming with cyprinoids, but with representatives of no other family, was found after a freshet to have lost a large number of its species, and those remaining, represented by but few individuals; while percoids, heretofore wanting, appeared in the shape of Banded Sunfish (*Bryttus chætodon*), and Spotted-finned Sunfish (*B. punctatus*); also a few specimens of the Pirate (*Aphrodederus Sayanus*) were met with.

A third instance of alteration in the fauna, with no change in the bulk of water, occurred in the Shabbaconk Creek, a creek flowing into the Assunpink, which latter is dammed at its mouth, effectually preventing fish, leaving this creek, from returning to it. In this instance, the *Aphrodederus Sayanus*, which, for several seasons previous to 1867, had been abundant, suddenly disappeared. We have searched for them repeatedly since, but never have taken a single specimen. In the Assunpink Creek, where these "pirates" it would seem must have gone to, we have also carefully searched, but its extensive basin has not yet furnished a single specimen.

Such experiences of one familiar with these waters for fifteen years, explain why it is that different visitors in a few years examination of a stream or neighborhood, will in their reports differ considerably. One's own notes may be very inconsistent, on comparing those of any year with that of the preceding or following season. Even to the smaller cyprinoids, that are, we would suppose indisposed, if able, to migrate, we have applied the terms "abundant," "rare," "numerous," "scarce," at different times. More frequently these contradictory "remarks" were jotted down with reference to the occupants of small streams, but not altogether so. It is our custom *now* to look upon the contents of any one stream as but very imperfectly showing the fauna of that neighborhood, for two water-courses similar in all respects to the eye, *may have* no species common to each, although but two or three miles distant. In concluding what we have to say under this head — of changes in faunæ—we would call attention to our experience in finding ourselves apparently or really in error. Frequently we have failed to produce for visitors what we claimed in publications as easily obtainable; so we have been forced to the conclusion that only a series of examinations, covering three or four years, will warrant one in asserting *positively*, that this or that species is a denizen of such and such waters. An instance of this presents itself forcibly now in the fact that during the past summer a few specimens of *Pomoxis hexacanthus* were caught in the Delaware River. They were not caught here before 1869, and *may not be here* during the coming summer. Through canals a few specimens might have strayed into the Delaware, or it may be they were the pioneers of the species hereafter become resident, but the fact, as it *now* stands, goes for nothing in deciding the geographical range of that species.

Recently discovered species. Professor S. F. Baird, during the summer of 1854, discovered, in New Jersey, three fresh-water percoids, the Banded Sunfish (*Bryttus chœtodon*), the Spotted Olive Sunfish (*Bryttus obesus*), and the Mud Sunfish (*Ambloplites pomotis*). Sometime later Dr. Cheston Morris discovered in the Delaware, near Philadelphia, the *Pomotis* (*Bryttus*) *punctatus*, which we now believe to be distinct from *B. obesus*. With reference to the three latter species, we have only to say that their dull coloring and general similarity to other species may have caused them to be overlooked; but we very much question if they were any way near as abundant before detected by Baird and Morris, as they now are. With the *Bryttus chœtodon* the case is different. A year later than the date of Baird's discovery of this species, in Atlantic County, it appeared sparingly in Watson's Creek (Mercer County), a tributary of the Delaware. Since then it has been crowding out the old time "Sunny" (*Pomotis aureus*), although never reaching over one-third the size of that sunfish.

This fish (*B. chœtodon*), considering its clear silvery and jet black markings could never have been overlooked. *Wherever* it was previously to 1855 it *then* became an addition to the fauna of Mercer County, and of New Jersey, *about the time* of its discovery by Baird we believe. Few in numbers at first, it has steadily multiplied until now it is fully as common in a few streams as the *P. aureus* is in many others.

To pass now from quiet shady waters to the rapid hill-side brooks, let us discuss the active little cyprinoid, called, by Girard, *Cyprinella analostana*, and shown by Professor Cope to be the *Hypsilepis analostanus*. This little fish, we know, was not a common species, we doubt if it was an inhabitant of our waters at all twelve years ago; and now four-fifths of the streams, besides the shallow rapid waters above the falls in the river, are literally full of them. Discovered by Kirtland in 1845, in the Ohio, did they work their way from there to here, or how became they so abundant in New Jersey, we might say, suddenly? If they were throughout the past century, say, a resident of our waters, with so few individuals of their species in existence as to escape detection or to be confounded with others, what caused their numbers so suddenly to increase, that now they are taking the place of the old-fashioned Red-fin (*Hypsilepis cornutus*)?

In the absence of any facts to the contrary we have jumped at the conclusion, that these "newer species" were *to us*, "newer creations." If created of old then some undetected alterations in our waters must be going on that some few years since gave them an impregnable advantage in the struggle for existence, and which will give other species now overlooked, ultimately, a similar advantage. Granting this why do we not come across the few specimens that are now merely preserving their kind until the favorable moment arrives for their assuming a multitudinous existence? As far as we know the "rare" species of the present have somewhere localities where they are abundant, and those with us are those that are "pioneering," and are always in direct communication with the river basin where the mass of their species dwell.

Habits of fresh-water fish. We have never met with any elaborate treatise upon this subject; and have been surprised that it should be so little referred to by those who have so carefully described the fish themselves, unless it is that the describer has not generally been the collector. "Clear water," "muddy streams," "rapid creeks," "sluggish brooks," and such phrases cover the whole ground, frequently, of the habits of the species, unless like the stickle-backs they do something so marked that it cannot well be overlooked. The introduction of aquaria has not done much to elucidate the subject, in consequence of the meagre dimensions of the tanks and carelessness to imitate nature. To what we propose to refer now, more particularly, is that the habits of the same fish *vary much in accordance with their surroundings*, and that the various species *are not as confined to certain kinds of streams as is usually supposed.*

We make these two statements after a careful résumé of our many notes, giving them as the result of eleven years study of the habits of the forty-nine species, that are found in the Delaware River or its tributaries, within five miles of Trenton, in one direction or another. Take the ten percoids as an example. We have found them in every variety of water the neighborhood produced, even to the little rivulets, where young *Pomotes* and *Brytti* hovered behind rocks, in the stiller water, but dashed *up stream* on being disturbed. Now these "sun-fish" as a class, are denizens of still water; but the exceptions are not so few, as to be put under the head of "merely accidental." In sluggish, gloomy water, we have found many a school of White-perch (*Morone Americana*), that had but to swim a thousand yards to join their fellows in the swift waters of the river and like them prey upon the cyprinoids there abundant, but scarce in the muddy, quiet creek we mentioned. Often when fishing for pout and the larger Pike (*Esox reticulatus*), we have found these schools of White-perch, occasionally having the Rock-fish (*Roccus lineatus*) associated with them.

The *Aphrodederus Sayanus*, once abundant in a clear pebbly-bedded creek, is now occasionally found in deep waters with little currents, where the banks overhang sufficiently to give them a safe retreat.

The Bill-fish (*Belone longirostris*), is not sufficiently abundant in the river, to give one good opportunities of thoroughly studying it. During the summer, or autumn, numbers of them occasionally enter the Delaware and Rariton Canal at Bordentown, New Jersey, and thence come into the canal basins. When the water is let out of the canal in December these fish are sometimes caught in the basins which are a little deeper than the canal. In these puddles, if not discovered by boys, they will remain during the winter, half buried in the mud, and semi-torpid. On the opening of navigation in March they seem to be wholly revivified, and frequent this artificial water-course during much of the summer, but finally disappear. An accident brings them, but they adapt themselves to the surroundings, as their remaining during the summer shows. Occasionally seeing quantities of young about two inches long seems to show that they spawned in the canal. The common Barred Minnows, *Fundulus multifasciatus*, have occasionally been seen by the author in spring-basins, at a considerable elevation from the brook into which its waters emptied. How they got there was a question it was found difficult to answer. To pass from the brook to the spring head it was necessary to pass up little perpendicular falls of twelve and fifteen inches. Within a short time we came across a large number in a little pool about a yard in diameter, fed by a fall of just thirteen inches, and very nearly perpendicular. With a sudden onset, we forced them from their quarters and *saw several mount the fall*. The power of this fish to swim against the current is very great, and by exercise of it only could we explain their presence at fountain heads. *The mass of these fish are found in the river and tide water creeks*, but in some numbers everywhere that it is possible for any fish to live.

Many more instances might be given showing the wide range of territory and difference in habit in different localities, which these fish have; and how unsafe it is to judge from a casual circumstance or two, what may be the peculiarities of any species.

Under the headings of certain species we propose now to call attention to peculiarities that are specific in their nature, especially breeding habits of some of the less numerous residents.

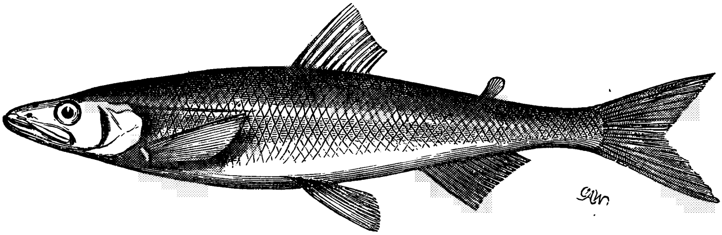
Banded Sunfish (*Bryttus chœtodon*). In the "Geology of New Jersey," page 807, the author under the above heading, says "this interesting species is a lover of weedy, sluggish streams and ponds, and is never met with in tide-water." We now, at this writing, are confident, that there is no fish in New Jersey found in other water not sometimes met with in tide water. Since the above quotation was put in print we have taken this sunfish from the "bellies" of shad-nets, which were drawn in decided tide waters, the Delaware and Crosswick's Creek. The breeding habits of this species have, during the past two summers, puzzled us considerably. That they occasionally scoop out a little basin in the sand, and there deposit the ova, is undoubtedly true; but not always is this the case we judge, as during April of 1868–'69, we found them in all sorts of out-of-the-way places, the females heavy with eggs, and in some instances, a female with a male at her side, were hidden at the foot of a tussock, with scarcely enough water to cover them. Two months later the ground over which they swam was perfectly dry. Was a severe battle going on between this species and the *Pomotis aureus*, that they were forced to hide themselves to preserve their ova from destruction? We did see some "nests" like those of *P. aureus*, but they were not abundant, as we had seen them previously. The other *Bryttus* is similar in his habits to the *Pomotis*, and is not so peaceable as the *B. chœtodon;* but preferring localities not favorites of other "sunfish," it does not interfere much with them. The coloration of both *B. chætodon* and *B. obesus* is very variable. On removing them from the water the black stripes of the former, and brilliant spots of the latter, are very distinct, but they soon fade even if replaced in water. In an aquarium, when first placed in it, they are dull, yellowish brown, with no distinct bars or spots, but in a short time they resume that coloring which easily distinguishes them from other sunfish; the *chætodon* becoming silvery, the *obesus*, deep olive.

Pirate Perch (*Aphrodederus Sayanus*). In the "Geology of New Jersey," page 808, we make the following statement: "The 'pirate' makes a nest after the manner of the sunfish, and with the female guards it and afterwards the young, till they reach a size of one-third of an inch, when they are left by their parents, etc." Since the above was written (1866) we have had some opportunities of farther studying the habits of this peculiar fish. We believe that they occupy the nests made by sunfish, but do not scoop them out for themselves. Furthermore this is not the only manner of breeding, but like many other fish they seek out-of-the-way places, as deserted burrowings of the musk-rats (*Fiber zibethicus*), and here the pair will remain several days, and when the young appear they are attended by the parents, or at least an adult pair, until they are about one-third of an inch. When young the Aphrodederus is very black, with a few pale, yellowish dots. The tail is margined with white, which disappears on the fish reaching an inch or more in length. The adult fish, measuring five inches in length, has been seen frequently to swallow one of its own kind measuring an inch.

Mud Minnow (*Melanura limi*). It would be an interesting question to solve in how little water and how compact mud this fish can survive. Its gills present nothing peculiar in themselves, and certainly are not powerful enough to squeeze water out of the mud in which we have found them buried, two (and one four) inches deep. On closely examining the bottom of any ditch one can easily detect the *Melanura* lying close upon the mud as quietly as an Etheostomoid,* but if at all disturbed they immediately dart off, and with a rapid twirl and twist of their whole body will bury themselves entirely out of sight at about an angle of forty-five degrees, tail down. We have often tried this in a shallow aquarium with mud on the bottom, and always with the same result. The movement is too rapid to be learned in detail, but they *always* bury themselves in a hole scooped out with their tail, which is the most deeply buried portion of their body.

A peculiarity of this fish worthy of note is the length of time at which it will maintain one position, especially a perpendicular one, head up and tail down. In an aquarium we have had them remain so four minutes, while we held just above the water a worm or fly. On slowly lowering these until they touched the water the fish would then seize them with a rapidity of movement equal to that of the trout. We have likewise seen them leap from the water a distance greater than their length, and seize insects that were upon blades of grass overhanging the ditch. The largest specimen of *Melanura limi* ever seen by the writer measured seven inches.

Fig. 30.



Smelt, *Osmerus mordax.*

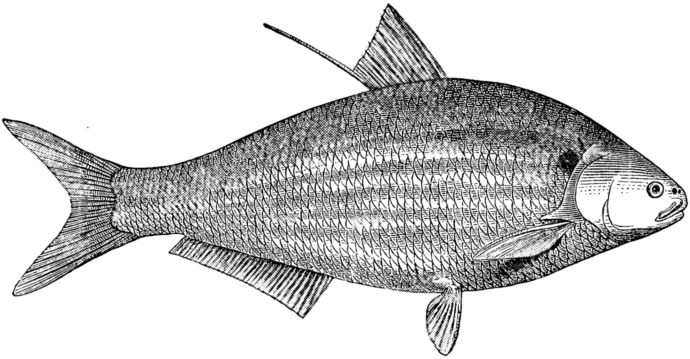
Frost-fish (*Osmerus mordax*). We desire to record here the fact of the presence of this fish in a few numbers during almost every month of the year. In August when the young shad are going down the river, we have seen single specimens of "smelt," or "frost-fish," as they are generally called. Occasionally also when fishing for White-perch (*Morone Americana*) we have caught them. In April there is very generally a freshet that submerges the tract of meadows bordering on the river south of Trenton. On the subsidence of this water the frost-fish are occasionally seen with a few herring in the small ditches, and are known then by juvenile anglers as the "silver pike." Hearing frequent mention of silver pike, I found this to be the fish referred to. Herring that are thus caught in ditches and cut off from the creeks do not live, but the *Osmerus* appears to thrive very well. The herring is the "Alewife" (*Alosa tyrannus*).

---

* In mentioning the number of fish in this neighborhood (Trenton, N. J.) as forty-nine, we did not include the *Etheostomoidæ*, and the few stickle-backs that come and go. Both these families as represented in the Delaware will be studied and published in a separate paper.

Gizzard Shad (*Dorosoma Cepedianum*). We gave a short notice of this species in the "Geology of New Jersey," page 822, which we will quote and speak of more particularly. "Occasionally the 'gizzard shad' is carried by a freshet into inland streams usually having very small outlets, and thus imprisoned they thrive very well. A pond near Trenton was, in 1857, stocked with them, and is now full of specimens, some weighing five pounds apiece." Besides this pond

Fig. 31.



Gizzard Shad, *Dorosoma Cepedianum.*

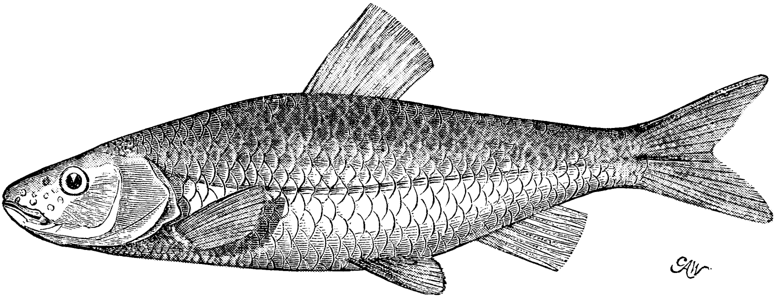
spoken of we know of one or two creeks that are annually visited by a few of these herring, and have occasionally seen *several bushels* hauled from the deep holes in the creeks they had entered. They appear in the Delaware early in March, before the other representatives of the Clupeidæ do, and as they are not ever taken in very great numbers, as are the other herring in the river, we judge that the immense quantities occasionally taken in creeks, is to be explained in the suggestion that those that come in the spring do not return. We have seen them in mid-winter frozen to death, apparently, and have reason to believe that they bury themselves in the mud when they take up their winter quarters in creeks and ponds.

The specimens we first met with, and described as *Chatoëssus insociabilis*, were from the pond referred to, stocked in 1857. They were different in coloration from the same fish as found on the coast and in the Delaware, and appeared to be distinct. If these *Dorosomœ* are left to themselves, unvisited by others later from the coast, will they in time become so far changed by the change in their surroundings as to be a different species? We thought them distinct in 1860, and the *Dorosoma*, from this same pond, is a different looking fish *now*, in 1870, from what it was *then*. The difference being one of color only it suggests the question as to whether the character of the water influences the characteristic coloring of species?

The Chub (*Semotilus rhotheus* and *S. corporalis*). In all the tributaries of the Delaware, as well as in the river itself, "chub" abound. There are several points in their history that we cannot fully understand when reading what has been published of the two species, especially "Cope's Monograph on the Cyprinidæ of Pennsylvania." This author very correctly gives the Delaware as *the locality* of the *Semotilus rhotheus*, and admits the presence of *S. corporalis*. Now in the Delaware, at Trenton, "chub" are very abundant, as we described them in 1861, which description Cope says is his *S.*

rhotheus, and we agree with him; but in addition he says the *Cyprinus atromaculatus* is the young of the *S. corporalis*. If such were the case then why are not the adult *S. corporalis* abundant in the river in proportion to the presence of the young in the smaller streams? The true *corporalis* is scarce, very scarce, yet the *atromaculatus* is abundant. This, of course, is an absurdity; but these *atromaculati* are not young *rhothei;* that fish when young is wholly different in color, being wholly silvery on the sides and belly, the silver becoming roseate near the back, which is "deeply, darkly, beautifully blue."

Fig. 32.



Chub, *Semotilus rhotheus.*

We have endeavored for several years to collect specimens of *atromaculatus* of all sizes, and so see where and when they cease to be *atromaculatus* and become true *corporalis.* We have as yet failed to do so, and have been somewhat disposed to consider it *not the young* of any species for these reasons. It is a peculiarly brook-loving species, hovering about deep holes, and most ingenious in its mode of eluding the pursuit of collectors. They are never found (that is, have not been by us) associated with the young of true "chub" as that fish is known. Their peculiar markings render them at once distinguishable from the young of *S. rhotheus*, and the two love very different waters, the *S. atromaculatus* loving muddy bottoms, in which they half bury themselves, while the young of *S. rhotheus* are fond of and frequent always pebbly-bottomed, rapid brooks. To recapitulate, we have, in the Delaware River and its tributaries, the *Semotilus rhotheus* in abundance, likewise the young in the directly tributary streams, equally numerous — and in certain streams, some cut off from the river by dams, the fish described by Mitchell as *Cyprinus atromaculatus*, which reaches a length of six and seven inches, and presents a coloration of black, yellow, reddish and silvery, like no other fish of our waters. If these are the young of the *Cyprinus corporalis* of the same author, why have we not this latter fish in abundance also? But we have not. Again, in streams, as the Assunpink and Shabbaconk, which are cut off from the Delaware by dams, and in the Stony-brook and Mill-stone, which are cut off from the Rariton, we have *Semotilus atromaculatus which never cease to be such.* Do they die for want of the rivers to become the *S. corporalis?* If not, where are these larger chub? In Stony-brook and the Mill-stone we have also the *S. rhotheus*, from half an inch to nearly half a yard in length. The difference in the scales of these two species of "chub" render them distinguishable without reference to color; and the *S. atromaculatus* agree with the size and number of scales of *S. corporalis*, as given in the "Monograph of the Cyprinidæ of Pennsylvania," by E. D. Cope. We are not yet satisfied, however, that the atromaculated chub of the Delaware basin is the young of any other species.

Roach (*Stilbe Americana*). Professor E. D. Cope in his Monograph says of this fish: "This Stilbe rarely exceeds seven inches in length." In the various streams in which we find the "roach," it is so frequent an occurrence to meet with them eight, nine, and nine and a half inches in length, that we are surprised at the figure mentioned by Cope as the maximum length. Otherwise his remarks accord with our observations. These large specimens have the pectoral, ventral and anal fins brilliant orange, during the spring and early summer, and later the color is dimmed but not lost. The color of the body is, as given by him, of "a greenish, brassy, or golden lustre." Smaller specimens even during the spring have the fins black and the general coloration silvery; duller upon the back than the sides. This species is not as much annoyed by the approach of winter as are many of the cyprinoids, merely seeking deeper waters. By cutting a hole in the ice and letting down a well-baited hook they are readily taken, and the larger ones at this season are excellent eating to those who are not incommoded by the multiplicity of small bones. The largest "roach" we have ever seen measured exactly nine and seven-eighths inches.

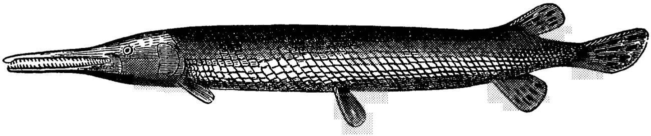
The Mud-sucker (*Hylomyzon nigricans*). In a tortuous tide-water creek, with unobstructed access to the Delaware, there are to be found at all seasons of the year where the water is deepest and the mud almost unfathomable, myriads of these "suckers"—old, young and middle-aged. Lazy, limp, almost lifeless, with a net they can be scooped up, offering no resistance, scarcely flapping their tails. As we follow up the course of this stream (Crosswick's Creek, Burlington Co., N. J.) we still find them tucked in under the overhanging banks, and so listless that on the receding of the water, at the turn of the tide, they sometimes are left high and dry before they are aware of it.* In other streams of New Jersey the fish is less abundant, and found usually with the "mullet" (*Moxostoma oblongum*). As an article of food they are good from December until April, and from then until winter are as near worthless as any fish well can be. We once saw a large specimen in the jaws of a Water-snake (*Tropidonotus sipedon*), which squealed like a young pig, more so than cat-fish have been known to do under similar circumstances, and showing greater indications of "a voice" than does the chub, which Cope says "utters a chirruping and croaking noise."

---

* A similar instance of this is very well shown by a far different fish, the Tessellated Darter (*Boleosoma Olmstedii*), which, in the same stream, follows the waters encroaching on the meadows at high tide, and settling in little hollows about, are not aware of the recession of the water until too late. Between tides we have gathered *over one hundred* in a space not over twenty yards square. Nothing in their stomachs showed what particular article of food they sought.

The Gar (*Lepidosteus osseus*). During the past summer while walking on the banks of Crosswicks Creek, we were attracted by a decided commotion in the water, and on nearing the spot found a young gar, probably eighteen inches long, surrounded by and evidently harrassed by a dozen or more Bill-fish (*Belone longirostris*). It soon disappeared by sinking out of sight, but reappeared soon near the shore, giving us an opportunity of watching it. It remained as motionless as an *Esox* for several minutes, and on the approach of a minnow would come as near the shore as possible, moving steadily backwards. If the fish came to about where the gar previously had been, it was seized in an instant, and the *Lepidosteus* would remain motionless until the approach of another Minnow would cause it to again draw back. We finally interrupted this "play" in an attempt to shoot the specimen. This fish we should judge was yearly becoming more scarce in the basin of the Delaware.

Fig. 33.



Gar pike, *Lepidosteus osseus*.

The Darters (*Etheostomoidæ*) as a class have been the most difficult to collect and study. They are with us in most streams exceedingly abundant, as also in the river itself. Lying motionless upon the flat stones or compact sand they readily escape detection, except by experts. As yet we have not made as elaborate a collection as we desire, but are satisfied we can show in this family some instances of wide geographical range, and one or more undescribed species.

Another family, the stickle-backs (*Gasterostei*), is one of much interest as found with us, but they are so uncertain in their stay in any stream that we have concluded to wait until another season's out-door work shall have given us farther opportunities to study them. The four-spined Stickle-back (*Apeltes quadracus*) as an instance, for several summers was quite abundant in several streams, and is now not seen in any of them. In Watson's Creek, in 1865, they were very abundant, and the writer found several nests; in later seasons they were still present but in fewer numbers, and during the summers of 1868–'69 they had disappeared. We were accustomed to collect them from the "bellies" of nets drawn in the river, and lately have been very unsuccessful in finding them.

During the present, almost completed winter, the Delaware River has not been closed by ice, and judging from appearances at the time of writing (Feb. 18, 1870), it is not likely to be so closed. The fishermen have been steadily engaged in their pursuit, and with draw and gill nets have captured in very unusual abundance the commoner resident species, and also single specimens of rare fish, rare either for the time of year, or for the locality. Some of these instances are sufficiently of interest to warrant recording them.

On the 20th of January, the weather warm and water wholly free from ice, a Shad (*Alosa præstabilis*), weighing four and one-half pounds, was taken a short distance from the city. It was supposed to have been a sickly fish that had not "gone out" in August of the preceding summer. Such was proved not to be the case however, by an examination of the contents of the stomach, which demonstrated that it had come directly from salt water. Among the mass of marine food was a partially digested Killi-fish (*Hydrargyra flavula*). The Shad was a female, with ova apparently as fully matured as in May. Two or three specimens of other representatives of the Herring tribe were captured about this time, but to what genus they belonged, the writer could not determine from what he heard. He did not see the specimens. The Gizzard Shad (*Dorosoma Cepedianum*), has been met with by single specimens and pairs, while fishing for "suckers" (*Catostomus*) and "chub" (*Semotilus*). The date is much earlier than any previous one, and probably more specimens have been taken. They were usually large, but were thin, sickly and sluggish in their movements. Probably but few of this species enter the river, or at least, come up as far as Trenton. When once they have wandered into deep ponds they will remain and breed. One pond, that has been stocked with them since 1833, contains now larger specimens than the writer has ever elsewhere seen.

On the 23d or 24th of January a healthy, strong, active Cod-fish (*Morrhua Americana*), weighing nearly four pounds, was taken in a draw-net. The stomach of this fish showed it had been in river-water for several days. The fisherman who took this specimen considered it the first instance of the kind on record, but such is not the case. Several have been taken about Philadelphia during the past twenty years. A unique occurrence, however, we believe to be the capture of a large Sturgeon in January. The Sturgeon is sensitive to the cold, but it would seem that the water had not been greatly chilled, considering the presence of this fish, which was fully as active as the species is during the summer months.

Of the resident fish that are to be taken in variable quantities during the winter, when the ice is not abundant, the sucker tribe and the Delaware chub are the principal. During the past few days the abundance of these fish has been remarkable, and in one day several bushels were taken. The number of chubs was very large and afforded excellent opportunities of examining their distinctive characters. They were all the *Semotilus rhotheus* Cope. None measured less than eight inches in length, and *every specimen, male and female, had the brilliant rosy and blue tints mentioned* *by the writer in describing this species in* 1861. Mr. Cope has stated, in his Monograph on the Cyprinidæ of Pennsylvania (Transactions American Philosophical Society), that the coloration given by the writer, was that of the male in spring. The description he alludes to was drawn up in the summer. Mr. Cope is correct as to the coloration being that of the breeding season, but the tints do not grow less distinct after spawning, and *the female is very nearly, if not quite, as highly colored during February, March and April.* Later, the female becomes silvery, but the male, *in clear waters*, retains his high coloring. In muddy, sluggish waters, the bright, rosy hue becomes a reddish brown; the blue tints become leaden. Of the smaller specimens none exhibited the peculiar cloudy markings of the *Cyprinus atromaculatus* Mitchell. The largest specimen, a female, measured fourteen inches in length, and exceeded all the others in the magnificence of its coloring. The examination of nearly three hundred specimens indicated clearly that the beauty of this species was in proportion to the size, and that the sex could not be determined by the color of the specimen.

Among this enormous quantity of specimens not a single *Semotilus corporalis* was found.

NOTE. — Early in the month of February of this year, the writer received a number of "frost-fish" or "smelt," from the Raritan River, N. J. Among these fish (*Osmerus mordax*) was a single specimen of a cyprinoid, which was new to the waters of New Jersey, and was considered at the time as undescribed. The specimen was submitted to Professor E. D. Cope, and has since been described by him in MSS., as *Hybognathus osmerinus* Cope. The paper containing the description will be issued soon in the "Transactions of the American Philosophical Society of Philadelphia."

This is the only species of this genus found in the state, and is, we believe, the third genuine species of *Hybognathus* of Girard, who has described many species as belonging to this genus, which have been found since not to be true *Hybognathi*. This makes the total number of *Cyprinidæ*, belonging to the fauna of New Jersey, fourteen.

In our report of the Zoology of New Jersey, we mentioned but three species of "suckers," as found in the state. We omitted the large scaled sucker, *Teretribus macrolepidotus*, which is very abundant in the Delaware River, about and south of Philadelphia, but it does not occur in numbers much north of the city named.